REMARKS

Claims 1, 3-4, 6, 8-10, 21 and 23-28 are currently pending in the application.

Claims 27-28 were added to recite that a portion of the reformed gas pathway heats the catalyst bed by direct heat transfer through a wall. Support for new claims 27-28 can be found throughout the specification (e.g., page 18, lines 11-17) and in the drawings (e.g., Fig. 3).

Also, claim 11 has been cancelled without prejudice to the filing of a divisional application directed to the subject matter thereof. Claims 2, 5, 7, 12-20 and 22 were previously cancelled, without prejudice, by amendment to the application.

Further, while not necessarily agreeing with the Examiner's § 112, second paragraph, rejection of claims 1, 21 and 26, claims 1 and 21 have been amended such that they now recite that the means for heating the downstream side of the catalyst bed is in a portion of the reformed gas pathway. Claim 26 has been amended to clarify that it is the reformed gas pathway which has a first direction prior to passing through said cooler, and a second direction after passing through said catalyst bed, wherein the first direction and second direction are opposing.

No new matter has been added by these claim amendments. Accordingly, entry of the claim amendments, and withdrawal of the Examiner's 35 U.S.C. § 112 rejection of claims 1, 3-4, 6, 8-10, 21 and 23-25, are respectfully requested

The Examiner has once again objected to the drawings under 37 C.F.R. §1.83(a) implying that, in reference to claim 11, the "two or more reaction segments . . . connected in parallel" are not shown in the figures of the application. Although Applicants respectfully

disagree with the Examiner's objection for the reasons previously stated in the Amendment filed March 27, 2003, Applicants have elected to cancel claim 11 without prejudice to the filing of a divisional application directed to the subject matter thereof. Accordingly, withdrawal of the objection to the drawings is respectfully requested.

Allowable Subject Matter

At page 10, paragraph 9 of the Office Action (Paper No. 20), the Examiner states that claims 3-4 and 23-24 would be allowable if rewritten to overcome the 35 U.S.C. § 112, second paragraph, rejections and to include all of the limitations of the base claim and any intervening claims.

Applicants thank the Examiner for this statement of allowable subject matter. As stated above, Applicants have amended claims 1 and 21 in order to overcome the Examiner's § 112, second paragraph, rejection of those claims. However, at this time, Applicants have elected not to rewrite claims 3-4 and 23-24 in independent form as Applicants strongly believe that independent claims 1 and 21, from which claims 3-4 and 23-24 directly or indirectly depend, are allowable for the reasons set forth below.

Rejections Under 35 U.S.C. §102

The Examiner has rejected claims 1, 8-9, 11, 21 and 26 under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 3,962,869 of Wössner. The Examiner has also rejected claims 1, 8, 10, 21 and 26 under §102(b) as being anticipated by U.S. Patent No. 2,898,183 of Fauser. The Examiner argues that Wössner and Fauser disclose an apparatus essentially as recited in the rejected claims, and that the rejected claims structurally read on the apparatus of

Wössner and Fauser since the utilization of the apparatus for the oxidation of carbon monoxide in a reformed gas and the relative feed stream temperature are merely a matter of intended use. The Examiner also points out that a recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art and that, if the prior art structure is capable of performing the intended use, then it meets the claim.

Applicants respectfully, but strenuously, traverse the Examiner's §102(b) rejections based on Wössner and Fauser, and the arguments in support thereof, for the reasons that follow.

The use of the claimed invention results directly from the structure of the hydrogen purifying apparatus which is significantly different from the apparatus of both Wössner and Fauser. Importantly, neither the insulated heat pipe of Wössner nor the high pressure apparatus of Fauser contains a second (oxidant) gas supplying segment for supplying a second (oxidant) gas to a first (reformed) gas pathway (see amended claims 1 and 21). Moreover, neither Wössner nor Fauser provide a means for heating a downstream side of a catalyst bed which is a portion of the reformed gas pathway located in proximity to the catalyst bed and separated from the catalyst bed by a wall so as to heat the downstream side of the catalyst bed by a reformed gas (see amended claim 1).

Instead, Wössner describes an insulated heat pipe for exhaust gas detoxification in internal combustion engines having an internal capillary tube along which a condensed heat transfer medium flows toward a heat source and within which a vaporized medium flows toward a heat sink (Abstract). More specifically, the heat pipe is a heat flow transformer having three sequential zones: an evaporation zone; a transport zone thermally insulated with respect to the

outside; and a condensation zone, wherein, if a working medium is suitably chosen (e.g., sodium), a reactor will transport heat only after it has achieved a particular working temperature (col. 1. lines 46-52 and 66-67, and col. 3, lines 18-20). Thus, the capillary inner tube internally conducts the working medium in vapor form streaming toward the condensation zone and externally helps to conduct the working medium in liquid form towards the evaporation zone (col. 1, lines 52-57 and Fig. 5).

In the embodiment of Fig. 5 of Wössner, improvement of the heat transfer process is achieved by providing, in addition to a primary heat pipe, several secondary heat pipes whose evaporation region is in positive thermal contact with the condensing region of the primary heat pipe (col. 4, lines 41-46). More specifically, Fig. 5 of Wössner shows a reactor in which the heat pipe 33 is a double-walled pipe through whose inner pipe 34 exhaust gas is admitted and is then reversed as it flows through the catalyzer region 32' and, finally, around the exterior of the heat pipe 33 and beyond (col. 5, lines 26-30). The capillary tube is disposed in the space 33' between the pipes 33 and 34 (col. 5, lines 30-32), and an evaporation region 35 of a second heat pipe extends into the inner pipe 34 from the terminal side of the condensation region 36 of the second heat pipe, which protrudes from the reactor 32 and communicates with a gas container 38 (col. 5, lines 35-42 and Fig. 5). As a result, the temperature of the exhaust gas streaming through the inner pipe 34 can be held within certain limits before it reaches the catalyst because of the variable heat transfer rate to the secondary heat pipe (col. 5, lines 42-46).

With this understanding of Wössner, it is apparent that the structure of the apparatus of the present application, as recited in claims 1 and 21, is different, not only from the structure of the heat pipe disclosed by Wössner, but also from the equipment for exhaust gas detoxification of internal combustion engines as embodied in Figure 5 of Wössner. Importantly,

Wössner does not teach or suggest a second (oxidant) gas supplying segment for supplying gas to a first (reformed gas) pathway as in the present invention. Instead, the perpendicularly connected inlet to heat pipe 33, referred to by the Examiner, is in communication with the capillary tube disposed in the space 33' between the pipes 33 and 34 (see Fig. 5 and col. 5, lines 30-32). As a result, it is understood that the perpendicularly connected inlet to heat pipe 33 provides the working medium to the capillary tube which conducts the working medium in vapor form streaming toward the condensation zone and externally helps to conduct the working medium in liquid form to flow towards the evaporation zone (col. 1, lines 52-57). This is significantly different from the oxidant gas supplying segment which supplies oxidant gas to the path of the reformed gas pathway as recited in claims 1 and 21 of the present application (compare Fig. 5 of Wössner to Fig. 3 of the present application).

Further, as a result of structural differences between the apparatus of Wössner and the claimed apparatus, the catalyst of Wössner is heated by a working medium, whereas the catalyst in the present application is heated by a reformed gas. More specifically, as clearly understood from Fig. 5 of Wössner, the catalyzer region 32' of Wössner is heated by the heat of the evaporated working medium flowing through the capillary space 33' between the outer pipe 33 and the inner pipe 34. This is different from the present invention wherein the means for heating the downstream side of said catalyst bed is a portion of the reformed gas pathway located in proximity to the catalyst bed and separated from the catalyst bed by a wall so as to heat said downstream side of said catalyst bed by the reformed gas before passing through a cooler (see e.g., claim 1 and Fig. 3). In other words, another important structural difference between the claimed apparatus and Wössner is the inclusion of a wall which enables the means for heating to be proximately located with the catalyst bed in order to conduct heat transfer without the need,

for example, of a double-walled pipe and a working medium contained in a space between the pipes as described in Wössner.

Additionally, in further support of claim 21, Applicants point out that, contrary to the Examiner's assertion, Wössner does not teach or suggest a reformed gas pathway that at least partially surrounds a catalyst bed. Instead, the specification describes and the Figures of Wössner show the catalyzer region outside of the heat pipe (see, e.g., Figs. 1 and 4-5). Thus, Wössner does not anticipate the structure of the hydrogen purifying apparatus as recited in claim 21 wherein said reformed gas pathway at least partially surrounds the catalyst bed (see, claim 21 and Fig. 3).

For the reasons stated above, Wössner does not teach or suggest all of the elements recited in claims 1 and 21. Also, since claims 8-9 and 26 depend directly from either claim 1 or claim 21, Wössner also does not teach or suggest all of the elements recited in claims 8-9 and 26. Therefore, Applicants respectfully request reconsideration and withdrawal of the §102 rejection based on Wössner.

Fauser also does not teach or suggest all of the elements of the claimed invention. Importantly, like Wössner, Fauser also does not teach or suggest a second (oxidant) gas supplying segment for supplying oxidant gas to a reformed gas pathway as in the present invention. Instead, Fauser is directed to an apparatus, and process, for performing exothermic reactions under high pressure and elevated temperatures wherein a <u>single</u> compressor conduit or pipe M, containing a compressed synthesis gas (a mixture of nitrogen and hydrogen), is in communication with a tubular reaction vessel or furnace A (col. 2, lines 18-22 and Fig. 1).

More specifically, Fauser provides an apparatus whereby the pressure in the reaction vessel A is applied to coolant circulating through heat exchanger pipes via the vessel V,

so that the coolant pressure within the pipes is always substantially the same as the pressure in the reaction vessel A to which the pipes are subjected (col. 1, lines 66-71 and Fig. 1). To this end, as shown in Figure 1 of Fauser and as described in the specification, a portion of the compressed synthesis gas is passed through the upper portion of vessel V from compressor pipe M through a branch pipe controlled by a valve S in order to improve the cooling of motor N and to more safely prevent the escape of coolant from vessel V into the conduit system (col. 3, lines 14-19). The remainder of the synthesis gas proceeds along the compressor pipe M to the reaction vessel A (see Fig. 1). Thus, it is a portion of the synthesis gas, and not a second gas, which passes through a branch of pipe M, and not a second gas supplying segment. Accordingly, contrary to the Examiner's position, Fauser does not teach a second (oxidant) gas supplying segment for supplying a second (oxidant) gas to the first (reformed) gas pathway as in the present invention.

Additionally, unlike the claimed hydrogen purifying apparatus, the apparatus of Fauser does not teach a structure whereby a means for <u>heating</u> a downstream side of a catalyst bed is a portion of the reformed gas pathway located in proximity to the catalyst bed and separated from the catalyst bed by a wall so as to <u>heat</u> the downstream side of the catalyst bed by a reformed gas (see amended claim 1). Instead, the compressed synthesis gas in the apparatus of Fauser flows around, for example, the catalyst layer B_1, enters the catalyst layer B_1 at a temperature of about 400°C, and exits the catalyst layer B_1 at a temperature of about 550°C (see col. 2, lines 21-30 and Fig. 1). Thus, the temperature of the catalyst layer B_1 is higher than the temperature of the synthesis gas as the synthesis gas flows around the catalyst layer B_1. As a result, in contrast to the present invention, the catalyst layer B_1 is <u>cooled</u> (not heated) by the synthesis gas as heat from of the catalyst layer B_1 is transferred to the synthesis gas.

Moreover, unlike the claimed hydrogen purifying apparatus, the apparatus of Fauser does not teach a structure whereby a cooler cools an upstream side of a catalyst bed as recited in the claimed invention. As shown for example in Fig. 3 of the present application, the reformed gas is cooled as it passes through heat exchanger 17, before passing through the catalyst layer 11 formed inside the reaction chamber 18. In contrast, Fauser teaches heat exchangers C_1, C_2, C_3 which are located downstream of catalyst layers B_1, B_2, B_3 (col. 2, lines 33-35 and Fig. 1). A valve H_1 connected in series with coil C_1 permits the volumetric flow rate of the cooling water to be proportioned in accordance with the intensity of the heat developed by the reaction in catalyst layer B_1 (col. 2, lines 38-41). Thus, the mixture of N_2 and H_2 gas is cooled only after it leaves a catalyst bed (e.g., B_1) and enters a cooling device (e.g., C_1) (col. 2, lines 29-32 and Fig. 1).

The structural elements and arrangement of primarily the cooler 17 and the reaction chamber 18, as recited in claims 1 and 21, enable the hydrogen purifying apparatus of the present invention to establish a wide and stable temperature profile along the catalyst layer 11 (see Fig. 3). More specifically, the structure of the apparatus enables the formation of a temperature zone or profile such that CO is most efficiently reacted with the catalyst layer (page 15, lines 26-28). This is true regardless of whether there is a change in the temperature of reformed gas or the cooling medium in the cooler such that these changes would not interfere with the stable removal of CO (page 16, lines 2-6). Also, since the reformed gas flow pathway thermally insulates the catalyst layer 11, the temperature distribution in the center and the periphery of the catalyst layer ll becomes homogeneous, thereby enabling efficient oxidation of CO (page 18, lines 7-11). Moreover, because the reformed gas is cooled after passing through the cooler, the temperature of the catalyst layer 11 can be lowered at the upstream side and

elevated at the downstream side of the catalyst layer 11 (page 18, lines 17-20). As a result, the temperature distribution along the catalyst layer 11 can be optimized in response to selective oxidation of CO by the catalyst (page 18, lines 20-22). Thus, these improvements are possible as a result of structural elements of the claimed invention which are not taught or suggested by Fauser.

For the reasons stated above, Fauser does not teach or suggest all of the elements recited in claims 1 and 21. Also, since claims 8, 10 and 26 depend directly from either claim 1 or claim 21, Wössner also does not teach or suggest all of the elements recited in claims 8, 10 and 26. Therefore, Applicants respectfully request reconsideration and withdrawal of the §102 rejection based on Fauser.

Rejection Under 35 U.S.C. §103

The Examiner has rejected claims 6 and 25 under 35 U.S.C. §103(a) as being unpatentable (obvious) over Wössner or Fauser. The Examiner acknowledges that Wössner and Fauser are silent as to a gas flow rate control valve located on the second gas supplying segment for changing an amount of the second gas to be supplied in correspondence with a temperature of the catalyst bed. However, the Examiner argues that it would have been an obvious design choice for one of ordinary skill in the art at the time the invention was made to provide a gas flow rate control valve for the second gas supplying segment in the apparatus of Wössner or Fauser, on the basis of suitability for the intended use and absent a showing of unexpected results, since the Examiner takes Official Notice that the use of flow rate control valves for the regulation of gas supply to a reaction zone on the basis of temperature control is well known in the art.

Applicants respectfully, but strenuously, traverse the Examiner's §103(a) rejection and the arguments in support for the reasons set forth above as well as those that follow. As stated above, both Wössner and Fauser fail to teach or suggest a second gas (oxidant) supplying segment for supplying gas to a reformed gas pathway as recited in the claimed invention. It follows, therefore, that there is no motivation to modify the apparatus of Wössner or Fauser to provide a gas flow rate control valve located on a second (oxidant) gas supplying segment for changing an amount of oxidant gas to be supplied in correspondence with a temperature of the catalyst bed as described in the claimed invention. This is evidenced by the fact that both Wössner and Fauser provide a means for improving temperature control of their respective apparatus which is significantly different from that described in the present invention (see the above discussion).

Moreover, the air flow rate control valve 4 of the present invention is capable of supplying an air volume to the apparatus such that oxygen is regulated at one to threefold volume ratio with carbon monoxide (page 15, lines 1-4). Thus, the air flow rate control valve 4 is capable of establishing the oxygen to carbon monoxide volume ratio as the reformed gas enters the catalyst layer 1. Since neither Wössner nor Fauser teaches or suggests the importance of regulating oxygen to their respective apparatus, there is no basis for a reasonable expectation of success from providing a gas flow rate control valve as claimed.

For all the reasons stated above, Applicants assert that claims 6 and 25 are not obvious over either Wössner or Fauser. Accordingly, reconsideration and withdrawal of the Examiner's §103(a) rejection of claims 6 and 25 are respectfully requested.

Based on the foregoing Amendment and Remarks, Applicants respectively submit that the presently pending claims comply with the requirements of § 112. Moreover, in view of

the above Remarks, all of the claims are patentably distinct over the cited prior art. Reconsideration and withdrawal of the Examiner's rejections, and a Notice of Allowance, are respectfully requested.

REQUEST FOR INTERVIEW

In the event that the Examiner does not now believe the application to be in condition for allowance, Applicants respectfully request an interview with the Examiner to further discuss what amendments may be necessary for allowance of the claims. Applicants, by and through their undersigned counsel, will contact the Examiner in approximately one month to inquire as to whether it is necessary to schedule an interview with the Examiner.

Respectfully submitted,

KIYOSHI TAGUCHI *ET AL*

11/5/03
(Date)

By: Will C. Youngblood

WILLIAM C. YOUNGBLOOD
Registration No. 50,524
AKIN, GUMP, STRAUSS, HAUER & FELD, L.L.P.
One Commerce Square
2005 Market Street - 22nd Floor
Philadelphia, PA 19103-7086
Telephone: (215) 965-1200
Direct Dial: (215) 965-1246
Facsimile: (215) 965-1210
E-Mail: wyoungblood@akingump.com

WWS:WCY